



THE DEFENSE MONITOR

The Center for Defense Information supports a strong defense. It opposes excessive expenditures for weapons and policies that increase the danger of nuclear war. CDI believes that strong social, economic and political structures contribute equally to the national security and are essential to the strength and welfare of our country.

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SIMULTANEOUS TEST BAN:

A Primer on Nuclear Explosions

Defense Monitor in Brief

- The most significant and achievable arms control measure at this time is a Simultaneous Test Ban—the termination of all nuclear weapons explosions.
- The best date for a Simultaneous Test Ban to begin is 6 August 1985, which marks the 40th year since the atomic bombing of Hiroshima.
- A halt to nuclear weapons explosions can be verified to prevent cheating.
- Citizens must be well informed about all aspects of nuclear weapons testing to decide whether or not it should be stopped.

A complete and total halt to nuclear weapons explosions has been sought by every U.S. President since Dwight D. Eisenhower. In numerous arms agreements signed since 1963, the United States and the Soviet Union have pledged their efforts to achieve a comprehensive ban of nuclear weapons tests. Yet, today, 22 years after the signing of the Limited Nuclear Test Ban Treaty, both nations continue to explode nuclear weapons at the rate of 20 to 30 per year.

At a time when existing nuclear arms limitation agreements seem in danger of being abrogated—and prospects for new agreements are fading—an end to the explosive testing of nuclear weapons is the most significant and achievable arms con-

trol measure on the agenda today. This proposal that the U.S. and U.S.S.R. both stop testing nuclear weapons while negotiating a permanent ban on nuclear weapons explosions is called a Simultaneous Test Ban (STB). The date upon which the STB could take effect is a highly symbolic one: 6 August 1985, which marks the 40th year since the city of Hiroshima was demolished by an atomic bomb.

A Simultaneous Test Ban, by itself, could go far in slowing the on-rushing pace of the nuclear arms race. No less important, it could prove to be an essential first step in achieving other important measures to slow, halt and reverse this costly and potentially fatal arms competition.

"Today, relations between the United States and the Soviet Union are at a lower point than they have been for some time—a mountain of mistrust stands between us," Glenn Seaborg, former head of the Atomic Energy Commission, has said, "but I think there is a realization in both countries that steps toward a test ban can be to mutual advantage. Perhaps we need to think in terms of where we will be in another ten years if we don't come to an agreement."

This special issue of *The Defense Monitor* is a primer on nuclear testing and a Simultaneous Test Ban. Its easily referenced question-and-answer format explains how a complete and total halt to all nuclear explosions will make the world a safer and more secure place for all.

LIMITING NUCLEAR EXPLOSIONS: YESTERDAY AND TODAY

What About Early Test Ban Efforts? The first proposal for stopping nuclear weapons explosions was made by the U.S.S.R. in 1955, but became entangled in disagreements about verification. Three years later, the Soviet Union announced a moratorium on nuclear weapons explosions, calling on the U.S. and the United Kingdom to follow suit. After some six months of discussions, agreement on a year-by-year suspension of nuclear explosions was reached, beginning in November 1958. Remarkably, given the Cold War tensions of those times, the voluntary test ban was observed by the three nuclear-armed states for three years.

Although in December 1959 President Eisenhower officially terminated the moratorium by declaring, "We consider ourselves free to resume nuclear weapons testing," the U.S. conducted no tests. In February 1960 France exploded its first atomic weapon. The Soviet Union had stated that its adherence to the moratorium was dependent on no testing by any of the "Western powers," including France. Nevertheless, the U.S.S.R. did not resume testing until September 1961, after France had conducted four nuclear tests. The U.S. followed suit two weeks later.

Thus, while the history of earlier test moratoria is not unblemished, neither is it hopeless. A clearly defined moratorium today could pave the way for negotiations toward a permanent ban on all nuclear weapons explosions.

What is the Limited Test Ban Treaty? A 1963 nuclear explosions moratorium declared by the U.S. yielded enduring results. The Cuban Missile Crisis of October the year before proved a sobering experience for Presidents Kennedy and Khrushchev. Both world leaders emerged from their narrow brush with nuclear war filled with a new determination to secure a ban on nuclear weapons testing.

Much of the preliminary groundwork for test ban negotiations had

already been laid by 1963. In June of that year, President Kennedy made a bold stroke in a now famous speech delivered at American University. "To make clear our good faith and solemn convictions on this matter," he announced, "I now declare that the United States does not propose to conduct nuclear tests in the atmosphere so long as other states do not do so."

The following month, negotiations began in Moscow. It took only 12 days to negotiate the Limited Test Ban Treaty (LTBT), which forbids nuclear explosions in the air, underwater or in outer space. Only a minor, but unresolvable, dispute over the number of seismic detection stations to be placed in each other's territories precluded agreement on a comprehensive ban on all nuclear weapons explosions. *SU FAILURE!*

In order to gain the support of the military and the nuclear weapons labs for the LTBT, the Kennedy Administration agreed to certain "safeguards," including conduct of a "comprehensive, aggressive and continuing" underground nuclear explosions program and maintenance of facilities to "institute promptly nuclear tests in the atmosphere should they be deemed essential to our national security." Following the LTBT, therefore, the average annual number of U.S. nuclear tests actually increased.

While the treaty did not secure the comprehensive ban many had hoped for, it was still an important step. Above ground nuclear explosions had created a worldwide health hazard by generating dangerous radioactive fallout. By driving nuclear tests underground, the LTBT largely solved the fallout problem. Unfortunately, once the fallout danger was alleviated, public pressure for a comprehensive test ban slackened.

The LTBT pledged its parties to seek "to achieve the discontinuance of all test explosions of nuclear weapons for all time." Twenty-two years later, we are still waiting. It took worldwide public protests to pressure

government officials to abandon nuclear explosions in the air. A similar effort to secure a Simultaneous Test Ban could be equally effective.

What Other Treaties Limit Testing? In 1974, the U.S. and the U.S.S.R. signed the Threshold Test Ban Treaty (TTBT), restricting tests to no more than 150 kilotons. In addition, a protocol to the TTBT provides for the exchange of geological, seismic and other data to allow calibration of both countries' detection networks. Two years later, the Peaceful Nuclear Explosions Treaty (PNET) was signed, similarly restricting so-called "peaceful nuclear explosions"—underground blasts for civil engineering purposes. In 1976, both treaties were submitted to the Senate for ratification. Hearings were held in 1977 and the treaties were favorably reported to the whole Senate the following year. Threats by some Senators to add untenable verification amendments, as well as the Administration's deep involvement with the SALT II and Comprehensive Test Ban treaties, however, led President Carter to abandon the ratification process. *1978*

Neither the TTBT nor the PNET has yet been ratified by the U.S., although both countries have pledged to abide by them. The failure to follow through on the data exchange provisions of the TTBT has clouded the debate on future verification of a comprehensive ban on nuclear explosions. More generally, the U.S. practice of signing, but not ratifying, arms control agreements undermines the arms control process. ***

What About the Comprehensive Test Ban? In 1977 the Carter Administration began negotiating a Comprehensive Test Ban Treaty (CTBT) with the Soviet Union and the United Kingdom to stop all nuclear weapons explosions of all kinds in all environments. To gain the support of the military, the nuclear weapons labs, and others who didn't want a permanent ban on nuclear tests, Carter proposed that the treaty be lim-

but not by binding agreement

** Could SC do this without ratif.?*

ited to three years.

The CTBT negotiations in the late 1970s produced some dramatic breakthroughs. The Soviets agreed to several significant steps facilitating verification including acceptance of a network of seismic monitoring stations on Soviet territory and agreement in principle to the use of voluntary on-site inspections to resolve suspicious events.

As a result of intensive bargaining on all sides a draft treaty was written. The three parties were able to report to the United Nations in 1980 that they had "demonstrated their strong political commitment to completion of this treaty by achieving solutions to problems that for many years made a treaty difficult to attain. Most notable in this regard are the agreements concerning the prohibition of any nuclear weapon test explosion in any environment, the moratorium on nuclear explosions for peaceful purposes, the general conditions with regard to on-site inspections, and a number of important seismic verification issues."

While talks continued through 1980, however, events in Afghanistan and Iran and the troubled course of the still unratified SALT II Treaty killed any possibility of a ban on nuclear explosions during the Carter Administration. Two years later, the Reagan Administration—citing verification concerns—formally abandoned nuclear test ban negotiations.

What Initiatives Today Would Limit Testing? Because of the present Administration's adamant position on continuing nuclear explosions, new initiatives for securing a ban on nuclear testing are originating in the Congress. One such legislative move is House Joint Resolution 3, introduced in January 1985. H.J.Res. 3, like the Kennedy-Mathias Amendment which passed by a vote of 77-22 in the Senate in 1984, calls for ratification of the TTBT and the PNET and the resumption of CTBT negotiations with the Soviet Union. On May 15 H.J.Res. 3, which is a non-binding resolution, was approved by the House Foreign Affairs Commit-

"We All Inhabit this Small Planet"

"Both the United States and its allies, and the Soviet Union and its allies, have a mutually deep interest in a just and genuine peace and in halting the arms race. Agreements to this end are in the interests of the Soviet Union as well as ours—and even the most hostile nations can be relied upon to accept and keep those treaty obligations, and only those treaty obligations, which are in their own interest.

"So, let us not be blind to our differences—but let us also direct attention to our common interests and to the means by which those differences can be resolved . . . For, in the final analysis, our most basic common link is that we all inhabit this small planet. . . .

"To make clear our good faith and solemn convictions on this matter, I now declare that the United States does not propose to conduct nuclear tests in the atmosphere so long as other states do not do so."

President John F. Kennedy
American University Speech
June 10, 1963

tee, and reported favorably to the whole House of Representatives for action.

Another House proposal, introduced in March 1985, is H.R. 1834, called the Simultaneous Nuclear Test Ban Act. The STB Act seeks a mutual U.S.-Soviet three month cessation of nuclear explosive testing beginning 6 August 1985 and calls on the President to seek resumption of Comprehensive Test Ban talks. The STB Act is different from other test ban proposals in that it seeks a cutoff of funding for U.S. testing of nuclear weapons contingent upon a Soviet suspension of testing. The STB Act provides Congress a vehicle with which to bring about a cessation of nuclear weapons explosions.*

What do the U.S. & U.S.S.R. Say About a Test Ban? In November 1984, the Center for Defense Information sent a letter to President Reagan suggesting a mutual halt to all nuclear weapons explosions on 6 August 1985. In December the Center received a reply from Lt. General John Chain, USAF, Director of the State Department's Bureau of Politico-Military Affairs. "While it remains a long-term objective," General Chain said, "the U.S. does not intend to pursue negotiations towards a CTB at this time." As reasons, General Chain cited verification concerns and the Administra-

tion's belief that "nuclear testing plays an important role in ensuring a credible U.S. deterrent."

In January 1985, the Center sent a similar letter to the President of the Soviet Union. The Soviet response, received in April, was somewhat more encouraging. "The moratorium on nuclear testing as well as resumption in the near future of negotiations on a comprehensive ban on nuclear weapons tests," the letter from the Presidium of the Supreme Soviet said, "undoubtedly would contribute to constraining the nuclear arms race."

The letter went on to say that 6 August 1985 would be a good time to start and that "given acceptance of other nuclear powers, such a moratorium could be proclaimed even earlier." In a May 19 interview, Soviet leader Mikhail Gorbachev reaffirmed Soviet willingness to halt nuclear weapons explosions on 6 August 1985 while a comprehensive ban is being negotiated.

The Soviet government's response is encouraging. The U.S. government's somewhat less so. What is clear, is that one or the other of the nuclear powers will have to take the bold step of initiating a moratorium and challenging the other to follow suit, or we will never achieve an end to all nuclear explosions.

*Permanent? How long?

NUCLEAR TESTING TODAY

How Many Nuclear Weapons Have Been Exploded?

From 1945 through the end of 1984 the United States has exploded 756 nuclear weapons: 331 before the 1963 Limited Test Ban Treaty (LTBT) drove testing underground and 425 since. The Soviet Union has exploded 556 nuclear weapons since 1949: 164 before the LTBT and 392 since. Britain has exploded 38 nuclear weapons since 1952: 23 before the LTBT and 15 since. France has exploded 127 nuclear weapons since 1960, China 29 since 1964, and India one in 1974.

Recently, both the U.S. and the U.S.S.R. have been exploding nuclear weapons at an increasing rate. In 1982 the U.S. exploded 19 nuclear weapons, the highest number of tests since 1970. That same year, the Soviet Union detonated 31 nuclear devices, its highest number since the early 1960s. Last year, the five nuclear-armed nations conducted a total of 58 nuclear tests—18 American, 29 Soviet, 7 French, 2 British and 2 Chinese explosions—an average of more than one explosion per week.

In 1983, the Department of Energy, which conducts nuclear testing for the U.S. and monitors all nuclear testing worldwide, reverted to a policy which had been in effect from 1963 to 1975 of not announcing all nuclear explosions. Among the reasons the Department cited was that it

didn't want to help the Soviets "determine the detection limits they have." This action seems designed to impede verification of present and future test limitation agreements.

Where are Nuclear Weapons Exploded? The United States has exploded nuclear weapons in Alaska, Colorado, Mississippi and New Mexico in the U.S.; the Marshall Islands, Christmas Island, and Johnston Atoll in the Pacific; over the South Atlantic Ocean; and twice in Japan. Since 1974 all U.S. nuclear explosions have been detonated at the Nevada Test Site near Las Vegas, an area a bit larger than Rhode Island. The United Kingdom, which used to test its nuclear weapons in Australia and on South Pacific islands, has done all of its tests at the Nevada Test Site since 1962.

The Soviet Union conducts its nuclear weapons tests at three primary sites: the Arctic Island of Novaya Zemlya, north of the Caspian Sea, and Semipalatinsk in Central Asia. The U.S.S.R. has also detonated nuclear devices at other locations in Central Asia, the Ural Mountains and Siberia. In recent years, the Soviets have been conducting "peaceful nuclear explosions" (PNEs) for civil engineering projects in Siberia. Thirteen of 27 Soviet nuclear explosions in 1983, for instance, are presumed to have been PNEs. The U.S. last conducted PNEs, in Colorado, in 1973.

France at first exploded its nuclear weapons in the Sahara desert, but has tested on the South Pacific atoll of Mururoa since 1966. Only in 1975 did France stop exploding nuclear weapons in the atmosphere. China does all of its nuclear testing at Lop Nor in the Gobi desert. China has not exploded nuclear weapons in the atmosphere since 1980, and says that all future testing will be underground. India's 1974 nuclear explosion was detonated beneath the Rajasthan desert. India is not thought to have a nuclear arsenal.

How Much Does Nuclear Testing Cost? Exploding nuclear weapons underground is both costly and complicated. The budget for the U.S. nuclear testing program has doubled in only five years, from \$330 million in 1981 to the \$657 million requested for fiscal year 1986. The entire nuclear explosion program is estimated to have cost over \$7.5 Billion since testing went underground in 1963.

The cost of a single test varies depending on its complexity. One 1980 MX-related test, code-named "Miner's Iron," cost about \$28 million. But, according to the Department of Energy, "as we move towards the 1990s the design and, hence, the testing of nuclear weapons becomes more complex. . . . In particular, the underground tests are more complex because of the need for increased data from each experiment." It can take anywhere from one to two years to prepare for a single test.

How are Nuclear Weapons Tested? Nuclear weapons are tested either in vertical holes or horizontal tunnels. Holes are used for weapons design tests, and range from 600 feet to over one mile in depth. Tunnels—some as long as 8,000 feet—are used for weapons effects tests. The canister containing the nuclear weapon and the instruments for gauging the results of the test is placed into the hole or tunnel. After the device is in place, the shaft is filled with sand and gravel.

When the nuclear weapon is detonated by remote control all the earth

Simultaneous Test Ban "Long Overdue"

"My reaction to . . . a Simultaneous Nuclear Test Ban is one of strong enthusiasm. It is my opinion that a comprehensive test ban treaty is long overdue. We were close to a negotiation of one 9 or 10 years ago . . . and there is every evidence that the Soviet government would like to pursue this possibility at the present time. Negotiations looking to the conclusion of such a treaty would have the advantage of being a way of bypassing the current Geneva stalemate, which is unlikely to be overcome in the near future."

George Kennan
Former Ambassador to U.S.S.R.
Letter to Rep. Patricia Schroeder
April 15, 1985

surrounding it is instantly vaporized. The explosive energy compacts the earth to form a large spherical cavity and a layer of highly radioactive molten materials forms around the cavity. This material flows to the floor and solidifies as it cools.

The test holes are drilled to a depth calculated to contain the weapon's explosive energy and minimize "venting" or the escape of radioactive debris. Radioactive fallout has, however, vented from many of these tests and, according to the Department of Energy, has been detected after 228 tests—92 times on-site and 136 times outside of the Nevada Test Site.

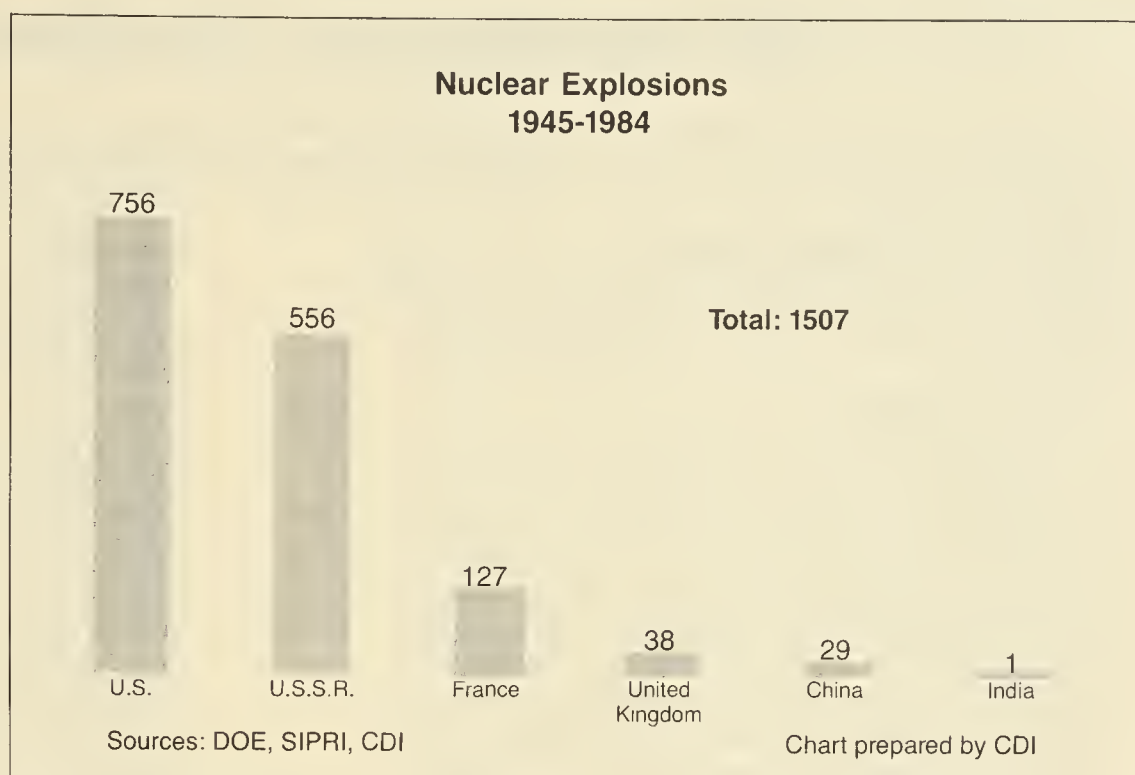
Why are Nuclear Weapons Tested? The reasons why the military wants to continue exploding nuclear weapons are perhaps best explained by the officials who manage the U.S. nuclear testing program:

- *Certifying New Designs.* "We cannot design this simple warhead from scratch on the basis of theory and our computational capability today and certify for you that that warhead is going to work as advertised," General William Hoover, then-Director of the Department of Energy's Office of Military Application, testified in 1981. "That is the fundamental reason we need to do testing and see where we have flaws. Quite frankly, we still have to verify a fudge factor after all these years."

- *Designing 'Safer' Weapons.* "We know how to make nuclear weapons more secure, safe . . . and controllable," General Hoover said in 1983.

Is the Test Ban Too Little, Too Late? Some allege it is too late for a halt to all testing to have a significant effect on the nuclear arms race. Designs for the thousands of nuclear warheads for the MX, Trident and cruise missiles slated to enter the arsenal during the 1980s have already been tested; a ban on testing would not halt these weapons.

Additionally, many of the major developments in nuclear design have



"By any measure of merit the weapons we produce today are far better than those placed in the stockpile years ago."

- *Assuring Reliability.* "From time to time," Ray Duncan, manager of the Nevada Test Site told Congress in 1983, "a weapon is extracted from the stockpile to assure it will still work in the manner in which it is designed." *How often?*

- *Arms Racing.* "I think it would be a terrible thing if the Soviets were to get ahead of us in the capability to design their nuclear weapons," Richard Wagner, Assistant to the Secretary of Defense for Atomic Energy, stated in 1982. "I think that the experience of Sputnik would pale in comparison with what would happen if

they got into this new generation of weapons designs before we do."

- *Preparing for Warfighting.* "The underground nuclear test program," Lt. General Richard Saxer, Director of the Defense Nuclear Agency (DNA), testified last year, "is . . . indispensable . . . to assess the survivability of our own military systems in a nuclear environment, predict lethality levels for destruction of enemy assets and develop the technology to enhance the survivability and security of our forces."

It is ironic that these military rationales for continuing testing are also compelling reasons for the U.S. and the U.S.S.R. to enter into an immediate Simultaneous Test Ban if the arms race is ever to be controlled.

SLOWING THE ARMS RACE

already been made, most important of which is the dramatic reduction in the "yield-to-weight" ratio. A modern 200-kiloton cruise missile warhead, for instance, weighs only 270 pounds, compared to early 20-kiloton atomic bombs, which weighed five tons. These small but potent nuclear devices have made possible the destabilizing multiple independently-targetable reentry vehicle (MIRV).

Further "improvements" in nu-

clear weapons, however, lie ahead. A total nuclear explosions ban would prevent these new, more devastating and—most threatening—more "usable" nuclear weapons designs from being developed. If a comprehensive ban on testing had been signed in 1963, we would not be threatened by the MIRV danger confronting us today. While the Department of Energy cites developments of better "safety"

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The Simultaneous Test Ban Papers

Over the past six months, the Center for Defense Information has been corresponding with the leaders of the U.S. and the U.S.S.R., urging them to join in a Simultaneous Test Ban, to take effect on 6 August 1985. Following are the texts of some of these letters.

CDI's Letter to President Reagan

On November 27, 1984, Rear Admirals Gene La Rocque and Eugene Carroll, Jr., wrote to President Reagan:

Dear Mr. President:

Congratulations upon your impressive victory in the election.

We note that since reelection you have repeatedly affirmed your commitment to the conclusion of effective arms control agreements with the Soviet Union. Toward this end we wish to suggest a first step which is readily achievable and would be of great value in slowing the pace of the nuclear arms buildup. It would completely bypass the current disagreements on INF and START issues and demonstrate your leadership as a man of peace.

This first, essential step is to propose a moratorium on nuclear testing and early resumption of negotiations on a Comprehensive Nuclear Test Ban. Based upon their Tripartite Report of July 31, 1980, the United States, the Soviet Union and the United Kingdom are already in substantial agreement on the elements of such a Test Ban. Dr. Herbert York, the chief U.S. negotiator, has stated that the Soviets were sincerely committed to concluding a treaty consistent with the terms outlined in the Tripartite Report, including provisions concerning on-site inspections. Your recent calls for the exchange of nuclear test observers appear to be a valuable contribution to meeting this requirement.

We have enclosed a recent *Defense Monitor* which explains the importance of an early end to nuclear testing. Since publishing this report in August, more than 100 organizations have already pledged their support to a world wide campaign to end all nuclear weapons explosions. The proposal will be considered soon by appropriate agencies at the U.N. We are certain that you will be applauded and strongly supported by a great majority of people in the U.S. and around the world, if you take the lead to bring an end to nuclear explosions forever.

It is impossible to conceive of a more dramatic and constructive way to begin your next four years as President of the most powerful nation on earth. By taking this bold initiative, you will dispel all doubts about U.S. commitments to effective arms control; place the onus on the Soviet Union to follow your leadership; and earn the approval of the citizens of the world for your service to the cause of peace.

The Administration Response

On December 31, 1984, the following response was received from Lt. General John Chain, Jr., USAF, Director of the State Department's Bureau of Politico-Military Affairs:

Dear Admiral La Rocque:

On behalf of the President I am replying to your letter of November 27 concerning a moratorium on nuclear testing and negotiations on a comprehensive nuclear test ban. A comprehensive test ban continues to be a long-term objective of Administration arms control policy, in the context of deep and verifiable arms reductions, expanded confidence-building measures, improved verification capabilities, and a strategic environment in which we would rely less heavily than today on nuclear weapons for deterrence.

The verification of a test ban and especially of a moratorium, remains a major problem. Expert testimony before Congress has indicated that, even in the context of the verification procedures discussed (but not fully agreed) in the CTB trilateral negotiations, there would still be some uncertainty about our ability to detect and identify a potentially significant level of clandestine testing.

The U.S. has supported international discussion of verification and compliance problems related to nuclear testing limitations. Such discussion has usefully taken place in past years at the multilateral Conference on Disarmament (CD) in Geneva where the U.S. continues to support consideration of monitoring and verification issues related to a CTB.

There also are significant concerns about the national security implications of a CTB or a moratorium. The security of the U.S. and our Allies depends on a credible U.S. nuclear deterrent, and nuclear testing plays an important role in ensuring a credible U.S. deterrent, particularly in view of the massive Soviet buildup of nuclear forces.

For these reasons, while it remains a long-term objective, the U.S. does not intend to pursue negotiations toward a CTB at this time.

The Administration is nevertheless determined to make progress in the area of nuclear testing limitations, and will continue to seek ways in which we can correct the serious verification problems associated with the Threshold Test Ban Treaty (TTBT) and its companion Peaceful Nuclear Explosions Treaty (PNET). The President, in his September 24 speech to the UN General Assembly, proposed that "we find a way for Soviet experts to come to the United States' nuclear test site and for ours to go to theirs, to measure directly the yields of tests of nuclear weapons." Although the initial Soviet response was not encouraging, we remain hopeful that we will soon receive a positive official response.

The Soviet Response

On January 18, 1985, Admirals La Rocque and Carroll sent a letter, similar to the earlier one to President Reagan, to the Soviet leadership. On April 15 the following response was received from the Supreme Soviet Pre-

sidium, as delivered to CDI by Ambassador Dobrynin at the Soviet Embassy in Washington:

Your statement, which testifies to the growing concern of the American public over the threat of devastating nuclear war, hanging over mankind, has been given a careful consideration in Moscow. The underlying motives of the proposal to undertake steps, which would help everyone to move forward to a desired goal, that of total elimination and prohibition of nuclear weapons for all time, to complete removal of the threat of nuclear war, are understandable.

The moratorium on nuclear testing as well as resumption in the near future of negotiations on a comprehensive ban on nuclear weapons tests, which you have proposed, undoubtedly would contribute to constraining the nuclear arms race. The Soviet Union has repeatedly proposed to the USA and other nuclear powers to put an end to such tests. It is one of the most acute and urgent issues now, since continuation of nuclear weapons testing is linked to their qualitative improvements, upgrading and creation of new types of such weapons and, consequently, whips up the build-up of nuclear arsenals.

To reach an agreement on complete and comprehensive ban on nuclear weapons tests the Soviet Union, and it is widely known, more than once put forward concrete initiatives and conducted negotiations in a constructive way. As you correctly note in your statement, in the course of trilateral negotiations on a comprehensive cessation of nuclear tests between the USSR, USA and Britain a long way was covered and the sides have achieved a considerable degree of agreement. Yet these negotiations were suspended by the United States Administration in 1980.

To create favourable conditions for working out the treaty, the Soviet Union also suggests such a practically feasible measure as declaration by all states, possessing nuclear weapons, of a moratorium on all nuclear explosions, beginning from a mutually agreed date.

The date the moratorium would take effect could be, as you suggest, August 6, 1985, which marks the 40th anniversary since the nuclear bombing of Hiroshima. Given the acceptance of other nuclear powers, such a moratorium could be proclaimed even earlier, so that it be in force until a treaty on complete and comprehensive ban of all nuclear weapons tests is concluded.

Under present circumstances, suspending nuclear explosions could be a very substantial step towards curtailing the nuclear arms race.

The Soviet Union is also prepared to resume immediately negotiations on complete prohibition on nuclear weapons tests. It proposes also to put into force the Soviet-American Treaties on the limitation of underground nuclear explosions, signed in 1974 and 1976, but not yet ratified for reasons that the Soviet side is not to be blamed for.

All these steps pertaining to nuclear tests, can be taken irrespective of the recently started talks in Geneva on issues of non-militarization of outer space, limitation and reduction of strategic armaments and medium-range nuclear weapons. At the same time, such measures would create more favourable conditions for

a fruitful development of the Geneva talks aimed at preventing an arms race in space and terminating it on Earth.

CDI's Response

On April 23 Admirals La Rocque and Carroll sent another letter to President Reagan, responding to Lt. General Chain's letter and discussing the Soviet response:

Dear Mr. President:

After receiving a reply to our letter to you of 27 November 1984, concerning the value of an early moratorium on nuclear testing, we addressed a similar letter to Mr. Chernenko on 18 January 1985. As you may be aware, a response was received to our letter via Ambassador Dobrynin on 15 April. We are enclosing a copy of that response for your consideration. We note with some concern the statement released by the State Department on this issue. As reported in the *Washington Post* on April 18th, the statement indicated that your advisors are "deeply concerned about the desirability of an uninspected testing moratorium and the verifiability of restraints on nuclear tests."

With respect to the second phrase, it is clear that "restraints on nuclear tests" would no longer be an issue if *all* nuclear explosions were banned. The 150 kiloton threshold limit and special provisions for so-called peaceful nuclear explosions would be subsumed in a total ban, thus eliminating any verification problems concerning limits or other restraints.

The question of verifiability therefore would become one of identifying, locating and classifying any low level nuclear explosions after the moratorium. There is a large body of independent scientific research which suggests that it is now virtually impossible to conceal any nuclear explosion, even at levels as low as one kiloton. We recognize that some scientists associated with the U.S. government nuclear laboratories may not agree with this finding and that the matter deserves further evaluation.

We recommend that the Secretary of Defense request that a prestigious body such as the National Academy of Sciences study this question and report their findings to you and the American people as they did on the question of a "nuclear winter." By this action you can obtain an authoritative determination concerning the verifiability of a mutual moratorium on nuclear testing. It is our belief that such a determination will enable you to announce a U.S. moratorium on nuclear testing with full confidence that any subsequent test within the Soviet Union would be detected promptly. If that occurred, the United States would be fully justified in resuming testing just as we did in 1961.

The positive tenor of the Soviet statement of 15 April relative to a moratorium on all nuclear weapons explosions on 6 August 1985 is encouraging evidence that the U.S.S.R. is willing to move ahead in this matter in conformance with an initiative by the U.S. government to end testing. Please consider a moratorium to be effective 6 August 1985 as the first and most important step you can take to slow, stop and reverse the nuclear arms race. The entire world will be safer and more secure if you will take this initiative.

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features for nuclear weapons as a reason to continue testing, most future "improvements," like those of the past, will prove dangerous. Moreover, necessary safety features can be incorporated into existing warhead designs without resort to nuclear testing.

Even the 1974 Threshold Test Ban Treaty has constrained nuclear weapons designers. "If you want to postulate a future warhead requirement with a yield significantly above 150 kilotons, for which no existing design is adequate," General Hoover has testified, "then we would have much less confidence in our ability to certify such a weapon." Imagine how much more limiting a *total* ban on nuclear weapons test explosions would be.

What New Weapons Would A Test Ban Prevent? Today, nuclear designers are developing a new, "third generation" of nuclear weapons. These weapons, according to one high Pentagon official, "could be the most significant change in nuclear weapons technology since the early days of the nuclear era." Development of this "third generation" is seen as a vital goal in the U.S./Soviet nuclear arms competition.

This "third generation" of nuclear weapons will be able to focus the awesome destructive force of nuclear weapons more selectively. "Neutron bombs," which emphasize deadly radiation over blast and heat, are early "third generation" nuclear weapons. Other new types of nuclear weapons under consideration would be used selectively to destroy electronics and to power laser weapons in space. Because the effects of these weapons will be more focused, they will be considered more usable, making it more likely that any war "goes nuclear."

While laboratory research and development on new weapons designs will inevitably continue under a Simultaneous Test Ban, the inability to actually test those new designs would inhibit the military on both sides from accepting them into their arsenals. "You can do all the calculations and modeling you want," Department of Energy official Troy Wade noted in 1982, "but the final

warm feeling you get in your stomach is when you've built one, tried it and proven that it will work."

How Would a Test Ban Affect Older Weapons? The U.S. regularly disassembles and inspects representative nuclear weapons in the stockpile. Occasionally this "stockpile surveillance" reveals manufacturing irregularities or component deterioration. If the "fixes" for such problems cannot be validated on the basis of previous testing, the redesigned weapon will be exploded to ensure it works as intended.

There are, however, other means available to assure a reasonable degree of stockpile reliability without nuclear explosions. These include explosive testing of the high-explosive trigger and other non-nuclear components, remanufacturing weapons to precisely the original specifications or with minor modifications after thorough review by experts, and replacing the suspect nuclear explosive with one which has previously been rigorously tested.

But the fact that the Department of Energy continues to explode weapons to assure stockpile reliability indicates that actual exploding of nuclear warheads is deemed essential. There is no adequate substitute for such reliability testing if the military is to maintain confidence in its weapons. Thus a ban on all testing would mean that, over a long period of time, there would be a gradual deterioration of confidence in the reliability of nuclear weapons in the arsenal. This lessening of confidence would by no means necessarily be an unwelcome development if we are to ease the "first strike" fears which today drive the nuclear arms race.

How Would a Test Ban Affect First Strike Capability? A gradual reduction in stockpile confidence would discourage either side from contemplating a preemptive "first strike" against the other's nuclear weapons. First strike weapons must perform precisely and reliably for any hope of success. By contrast, the nation launching a retaliatory strike would not need the same level of confidence in the precision and reliability of its weapons to do so effectively.

Non-nuclear explosive methods of maintaining reliability can ensure that a ban on testing would not be followed by a rapid deterioration of the nuclear stockpile which might degrade a country's ability to retaliate to nuclear attack. Any long term stockpile deterioration, of course, would affect both sides equally under a mutual, verifiable cessation of nuclear explosions.

Clearly, a Simultaneous Test Ban would permit the maintenance of retaliatory "deterrence," but would reduce the likelihood of a preemptive first strike.

How Would a Test Ban Affect Nuclear Warfighting? Some of the most important nuclear tests are conducted to gauge the effects of nuclear weapons on warfighting systems. The Pentagon and the Soviet military are both working to reduce the tremendous uncertainty which exists today about the consequences of the use of nuclear weapons.

"Over the years, weapons systems have become much more sophisticated," Edward Conrad, a Defense Nuclear Agency official, observed in 1982. "We started off with relatively simple systems . . . now we have very sophisticated semiconductor electronics. As sophistication grew, we had to look at how susceptible these systems are to enemy nuclear attack."

Far from being undesirable, this uncertainty serves to inhibit the possible use of nuclear weapons in war-time. One of the major uncertainties involves the effects of electro-magnetic pulse (EMP), an electronics-destroying surge of electricity created by nuclear explosions. The existence of EMP was discovered only shortly before the 1963 Limited Test Ban drove nuclear explosions underground. As a result, the military on both sides have almost as many questions as answers about how EMP might affect their ability to wage nuclear war successfully.

Limited study of EMP and other nuclear weapons effects can be conducted through underground nuclear explosions. A complete ban on nuclear weapons explosions would leave unresolved many questions on both

* not necessary; and if so, this could be obtained (despite Sherman)

sides about the nuclear susceptibility of their military systems. The resulting uncertainties, in a crisis, may prove the most decisive deterrent to nuclear war.

How Would a Test Ban Affect Proliferation? Halting all nuclear weapons explosions would lend much-needed credibility to the efforts of the nuclear-armed nations to halt the spread of nuclear weapons technology to non-nuclear nations. The 1968 ~~Non-Proliferation Treaty~~ pledges its 127 signers "to pursue negotiations in good faith on effective measures relating to the cessation of the nuclear arms race at an early date." The most effective measure that could be achieved at this time is a ban on all nuclear explosions.

By entering into such a ban, the nuclear weapons nations would take the first step to fulfill their 1968 pledge, demonstrating their commitment to disarmament, and at long last setting a positive example for nations trying to develop nuclear weapons. Some nations feel they, too, have a right to possess nuclear weapons as long as the U.S. and the U.S.S.R. are vigorously engaged in an unconstrained effort to develop ever newer and more usable nuclear weapons.

Who Would Benefit from a Test Ban? The importance of a ban on further nuclear explosions should not be underestimated. Without nuclear testing, the compact thermonuclear warheads that make possible multiple independently-targetable reentry vehicles (MIRVs) and long-range cruise missiles could never have been developed. There is near universal agreement that the proliferation of MIRVs and cruise missiles makes the world a far more dangerous place. ~~Thus~~ an STB would benefit *everyone* by reducing first strike capabilities, inhibiting war-fighting strategies, enhancing non-proliferation efforts, and, in general, helping to slow, stop and reverse the arms race.

From the more narrow perspective of the arms competition, a ban on all nuclear explosions would actually work to the advantage of the U.S. To date, the U.S. has conducted 200 more nuclear tests than has the So-

History of Efforts to End Nuclear Explosions

1954	Fallout from U.S. BRAVO test at the Bikini Atoll causes radiation casualties. Public awareness of testing health hazards increases.
1955	Nuclear-weapons states begin to consider limiting nuclear tests, but no action is taken.
1958	Soviet-proposed nuclear explosions moratorium goes into effect.
1961	Nuclear testing, at a very high rate, resumes.
1963	Following American-proposed nuclear explosions moratorium, Limited Test Ban Treaty, driving nuclear explosions underground, is signed and ratified.
1968	Non-Proliferation Treaty, which among other things urges an end to nuclear explosions, is signed, entering into force in 1970.
1974	Threshold Test Ban Treaty, limiting underground nuclear explosions to 150 kilotons, signed but not ratified by the U.S.
1976	Peaceful Nuclear Explosions Treaty, limiting engineering use of nuclear explosives to 150 kilotons, signed but not ratified by the U.S.
1977	Comprehensive Test Ban Treaty talks begin between the U.S., U.S.S.R. and United Kingdom.
1980	Comprehensive Test Ban Treaty negotiations suspended.
1982	Reagan Administration formally refuses further test ban negotiations.
1984	Non-binding Kennedy-Mathias Amendment, calling for ratification of the Threshold and Peaceful Nuclear Explosions Treaties and for resumption of Comprehensive Test Ban talks passes in the Senate by 77-32.
1985	Non-binding H.J. Res. 3, similar to Kennedy-Mathias Amendment, is approved by the House Foreign Affairs Committee (still pending). Binding H.R. 1834 (Simultaneous Nuclear Test Ban Act), to stop nuclear testing by 6 August 1985, introduced (still pending).

viet Union. It is widely agreed that the U.S. still has an edge on the Soviet Union in developing compact, efficient, and reliable nuclear warheads. An end to all testing would preserve this U.S. lead. Continued testing will erode it.

Additionally, because the U.S. is so far ahead of the Soviet Union in computer technology, it is better equipped to perform the simulations required to maintain stockpile reliability. The U.S. may thus actually derive a marginal benefit from a halt to all testing.

After the Test Ban, Then What? One of the most important benefits of a Simultaneous Test Ban is that it would serve as a "confidence building measure," facilitating further constraints on the nuclear buildup.

Once it has been demonstrated that each side is willing to take bold,

decisive measures to stop one type of military nuclear activity—testing nuclear explosives—additional measures can then be addressed. A logical next step, after the nuclear explosion moratorium has been made permanent by an international treaty, might be a similar ban on the flight testing of nuclear missiles, followed by a complete halt to the deployment of new nuclear delivery vehicles.

Usually the best remedy to a difficult situation is to take up the problems involved one step at a time. The drawback to many broad and sweeping arms control proposals is that they are generally not as simple as they first appear. There are many advantages to a step-by-step approach to lessening the danger of nuclear war and the first, essential step is a ban on nuclear weapons explosions.

* Don't we want that?
Behind the frontier?

VERIFYING A SIMULTANEOUS TEST BAN

Is Verification an Obstacle? Verification—the ability to assure that the other side is not cheating—is essential to any arms agreement. Our ability to verify a Simultaneous Test Ban is already excellent. Furthermore, redirection of only a fraction of the Billions of dollars now scheduled for research into space weapons, for instance, would go far towards resolving any lingering uncertainties about seismic detection of nuclear tests. Yet federal seismic research budgets are today being cut.

The Defense Advanced Research Projects Agency's geophysics research budget has been cut by \$1.7 million since the Reagan Administration withdrew from Comprehensive Test Ban negotiations. The Arms Control and Disarmament Agency today spends one-tenth the funds on test ban research it did in 1979. This year, the Senate Armed Services Committee added an additional \$10 million for verification research in 1986, for which the the Department of Energy had not seen fit to ask.

These budget cuts raise questions whether Administration concern about nuclear explosion verification has become more an excuse for political inaction than a valid reason to reject a total ban on nuclear testing.

How are Nuclear Explosions Detected? When a nuclear weapon

is detonated underground, shock waves pass through the earth (as body waves) and along its surface (as surface waves). Highly sensitive seismographic instruments can measure such motion—expressed as “seismic magnitude”—from distances of thousands of miles.

There are now more than 1,000 seismographic stations operating worldwide. Numerous stations operated by the U.S., including some located in countries bordering the Soviet Union, form the Atomic Energy Detection System, which is the U.S.'s primary means of detecting underground nuclear explosions.

Once a seismic signal is detected, the exact location of the event must be determined by comparing data from several different receiving stations. Pinpointing the location of the seismic event permits both a determination of whether or not it could possibly be a nuclear blast and the type of rock through which the signal passed, permitting accurate calculation of the seismic magnitude.

The U.S. ability to identify nuclear explosions is remarkably sophisticated. “We are certain that the state of knowledge of seismology and the techniques for monitoring seismic waves are sufficient to ensure that a feasible seismic network could soon detect a clandestine testing program

involving explosions as small as one kiloton,” geologists Dr. Jack Evernden of the National Center for Earthquake Research and Dr. Lynn Sykes of Columbia University reported in the *Scientific American* in 1982. “In short, the technical capabilities needed to police a comprehensive test ban down to explosions of very small size unquestionably exist.”

Most experts concur that a network of some 25 seismic listening stations within the Soviet Union, plus 15 or so surrounding it, and a similar network in and around the United States would provide high confidence verification of compliance with a Simultaneous Test Ban.

What About Compliance with Existing Test Treaties? The Reagan Administration has charged the Soviet Union with violating the Threshold Test Ban Treaty's 150-kiloton test limit. The allegations, which the Administration admits are based on “ambiguous” evidence, apparently arise from nine instances in which Soviet tests may have exceeded the limit.

U.S. measurement of Soviet tests, however, is based on seismic “yardsticks” derived from the geology of the U.S. test site, not that of Soviet test sites. Thus, Michael May, Associate Director of Lawrence Livermore National Laboratory, has concluded that “there is no evidence that the Soviets had cheated on the Threshold Test Ban Treaty.” David Emery, Deputy Director of the Arms Control and Disarmament Agency, stated in 1983: “I am convinced there is no conclusive proof the Soviets have violated [the TTBT].” According to geologist Dr. Lynn Sykes: “The allegations that the U.S.S.R. has violated the TTBT are based, in my opinion and that of many seismologists, solely on an incorrect calibration formula.”

Because of occasional uncertainty about the yield of new nuclear designs, the two sides agreed that “one or two slight, unintended breaches

“Soviets Would Treat This Initiative Seriously”

“I can think of no more appropriate way to mark the fortieth anniversary of the Hiroshima bomb than for both the superpowers to halt their testing of nuclear weapons.

“I personally feel the Soviets would treat this initiative seriously and constructively. It would be an American initiative very difficult for them to refuse. It would demonstrate that America has both the *vision* and the *confidence* to lead this planet in the struggle against the risk of nuclear war.”

*c.e. if we had persuaded
Cagney that a CTB
was worth pursuing for,
as R's wish.*

Ambassador W. Averell Harriman
Limited Test Ban Treaty Negotiator
Letter to Rep. Patricia Schroeder
April 24, 1985

(Rational— to press SU, “whether SU”

(not, to by have R?)

(So— SU initiative

*isn't really don't make the
effort in US & that it might*

(Still— nothing lost...

(Previous hole for expression?)

per year would not be considered a violation of the Treaty." Ratification of the TTBT would allow a seismic data exchange which would ease many of these verification ambiguities. Under a Simultaneous Test Ban, it would be a far simpler task to verify that *no* nuclear tests are being conducted than to determine whether or not explosions are being kept below a certain level.

Can a Simultaneous Test Ban Be Evaded? Opponents of a ban on nuclear tests contend there are several ways the Soviet Union could secretly test nuclear weapons. The method most often cited is "decoupling," whereby a nuclear weapon would be exploded in a large cavity deep underground. The cavity would reduce the compression of the earth that produces seismic waves so that only a relatively small fraction of the energy of the explosion could be detected.

This is more difficult to accomplish than it may sound. Excavation to produce a cavity large enough to muffle the seismic wave effectively would be nearly impossible to conceal from U.S. photo satellites. For instance, the volume of rock that would have to

be dug out to decouple an 8-kiloton explosion would be about the size of the largest Egyptian pyramid. The weapons chamber itself would have to be 300 feet in diameter, 3,000 feet below the surface. Furthermore, any venting of radioactive debris and surface cratering would have to be prevented to avoid detection by satellites and air sampling aircraft.

Other possible methods of evasion mentioned from time to time include: exploding a weapon in the aftermath of a large earthquake to conceal its seismic signal; devising methods to make an explosion mimic a natural geophysical phenomenon; and testing nuclear weapons in deep space. All of these evasion techniques are demonstrably infeasible in practical terms. For example, the U.S.S.R. would have to be ready to test 24 hours a day over an indefinite period in order to take advantage of exploitable—but unpredictable—seismic events such as earthquakes. Even then, the time available to conduct a test is confined to a few minutes at most.

The problem of differentiating earthquakes from nuclear explosions is eased by the fact that, of all earth-

quakes in the world, only about 0.5 percent occur in the U.S.S.R. close enough to the surface to be confused with nuclear explosions. Additionally, there are measurable differences between the seismic signals produced by earthquakes and nuclear explosions, regardless of their size.

Any secret explosions that could be conducted, however, would have to be so small as to be militarily irrelevant. In Congressional testimony, 5-to-10 kilotons has been cited as the threshold for militarily significant tests. Thus, even if a country were able to conduct a series of one-kiloton tests without being detected, it would gain no appreciable military advantage.

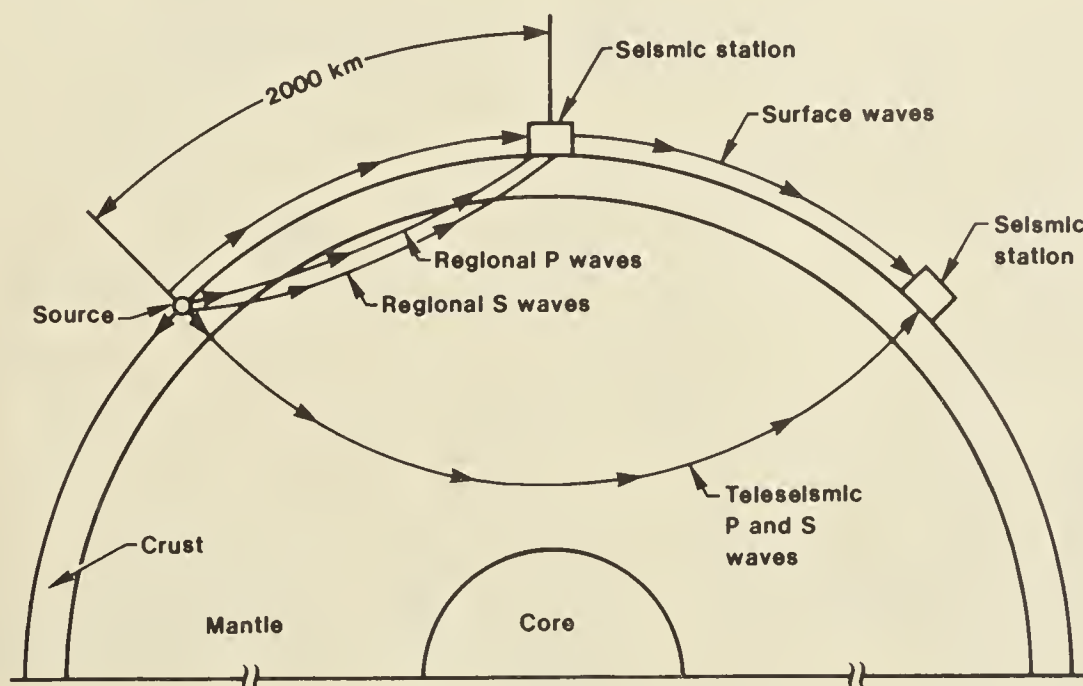
Present U.S. intelligence capabilities are sophisticated, efficient and mutually supportive. They provide us with the technical ability to detect and identify any significant Soviet attempt to violate an STB. Provisions for on-site inspection and in-country seismography—and other cooperative measures that have already largely been worked out in previous negotiations—would further guarantee our monitoring capability.

How to Detect Underground Nuclear Weapons Explosions

Earthquakes and nuclear explosions both generate seismic waves that travel through the earth. At teleseismic distances (i.e., more than 1,200 miles), there are two main types of wave: body waves, which travel through the earth, and surface waves, which move along its surface. Further, there are two main types of body wave: the P or compressional wave and the S or shear wave. One type of surface wave is called a Rayleigh wave. In trying to distinguish a suspected nuclear explosion from an earthquake, seismologists use the ratio of the magnitude of the P wave to that of the Rayleigh wave.

Because a total ban on nuclear weapons explosions will also be verified by seismic monitoring stations located in-country, many of the waves detected will be at regional distances (i.e., less than 1,200 miles). Regional seismic signals travel mainly in the upper mantle and crust of the Earth.

An earthquake generates significant amounts of S-wave and surface-wave energy, whereas a nuclear explosion produces minimal surface waves. The ratio of body-wave magnitude to surface-wave magnitude is thus lower for an earthquake than for a nuclear explosion of similar magnitude. Because a nuclear explosion radiates higher seismic frequencies than an earthquake, the ratio for P-wave amplitudes at different frequencies can also be used to tell the two types of events apart. (Source: Lawrence Livermore National Laboratory)



Finally, verification may not be so much a technical as a political issue. No treaty, however, tightly constructed, can ever be 100 percent verifiable. "If you insist on absolute cer-

tainy," Admiral Bobby Inman, former Deputy Director of the CIA, has noted, "if you insist on the capacity to detect every violation, you'll never have an arms control process. You have to take

some risks. The key is being confident that you will detect any serious cheating." Any large-scale cheating would be detected before it yielded military benefits.

sm JFR

Conclusions

- A Simultaneous Test Ban would go far to slow, stop, and reverse the nuclear arms race.
- A Simultaneous Test Ban would slow the current trend towards first strike capabilities and nuclear warfighting strategies.
- A Simultaneous Test Ban is an essential and achievable step in a series of measures which would restore confidence in the arms control process.

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